



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/581,441	01/12/2007	Yasuhiko Kasama	8075-1097	6604
465 7590 11/30/2009 YOUNG & THOMPSON 209 Madison Street Suite 500 Alexandria, VA 22314			EXAMINER DHINGRA, RAKESH KUMAR	
			ART UNIT 1792	PAPER NUMBER
			NOTIFICATION DATE 11/30/2009	DELIVERY MODE ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

DocketingDept@young-thompson.com

### Office Action Summary

**Application No.**

10/581,441

**Applicant(s)**

KASAMA ET AL.

**Examiner**

RAKESH DHINGRA

**Art Unit**

1792

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 22 July 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 12-22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 12-22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 June 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-8508)
- 4) ☐ Interview Summary (PTO-413)
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_
- Paper No(s)/Mail Date \_\_\_\_\_

**DETAILED ACTION**

***Response to Arguments***

Applicant's arguments with respect to claims 12, 13 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claims 12, 13 by adding new limitations like "configured to maintain".

Claims 12-22 are presently pending and active.

New references by Matsuoka et al (US 5, 022, 977) and Nakanishi et al (US 4,894,510) when combined with Gruen et al and Ahn et al read on limitations of amended claims 12, 13. Accordingly, claims 12, 14, 16, 18, 22 have been rejected under 35 USC 103 (a) as explained below. Further balance claims 13, 15, 17, 19-21 have also been rejected under 35 USC 103 (a) as explained below.

Regarding double patenting rejection, applicant's response has been noted. However pending progressing of either application to allowance stage, the double patenting rejection has been amended in view of amendment of claims 12, 12 as explained below.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

**Claims 12, 14, 16, 18, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruen et al (US 5,772,760) in view of Matsuoka et al (US 5, 022, 977, Ahn et al (US 6,454,912) and Nakanishi et al (US 4,894,510).**

Regarding Claims 12, 16, 22: Gruen et al teach a deposition apparatus 10 comprising plasma generating means including a plasma generating chamber, a microwave generator 23 and a pair of coils located around the plasma generation chamber. Gruen et al further teach means for introducing precursors (fullerene) comprising of a sublimation oven 14 with a gas introducing pipe (e.g. Figs 1A, 1B and col. 2, line 50 to col. 4, line 5).

Further, applicant has invoked 35 USC 112, 6<sup>th</sup> Paragraph in respect of following claim limitations:

“means for generating high electron temperature plasma”, for which the disclosed structure is – plasma generating chamber 2 made from quartz having a plasma gas introducing port 6, microwave generator 5, a pair of coils 71, 72 located around external wall of the plasma generating chamber 2 that form a magnetic mirror, and a four phase control helical antenna 8

wound around a gap between the coils 71, 72 such that a an electron energy of 15-50 eV is generated {Figs. 1, 2 and Para. 0026};

“means for introducing fullerene” for which the disclosed structure is –a fullerene sublimation oven 9 with a fullerene introducing pipe 10 (Fig. 2 and paragraphs 0032, 0039).

The apparatus of Gruen et al teach all limitations of the claim in terms of the structure disclosed by the applicant, but do not teach the plasma generating chamber made from quartz, the magnetic coils establish a magnetic mirror, a plasma gas introduction port, and a four phase helical antenna wound around a gap between the coils, and a precursor gas (fullerene) introducing pipe.

Matsuoka et al teach an ECR plasma apparatus comprising:

a plasma generating chamber 12 having a plasma gas introducing port 19, a microwave generator (not shown), a pair of magnetic coils 26A, 26B such that a plasma of electron temperature of 20eV to 100 eV could be generated (e.g. Fig. 5 and col. 8, line 50 to col. 10, 10 and col. 11, line 65 to col. 12, line 30 and col. 13, line 40-58).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the magnetic coils as a magnetic mirror as taught by Matsuoka et al in the apparatus of Gruen et al to enable electrons can receive energy efficiently due to electron cyclotron resonance.

Gruen et al in view of Matsuoka et al do not teach the plasma generating chamber made from quartz, and a four phase helical antenna wound around a gap between the coils.

However, quartz as the material for plasma generating chamber and having a plasma gas introduction port, and a precursor gas introducing pipe attached with the means for introducing fullerene are known in the art as per reference cited hereunder.

Ahn et al teach a plasma deposition apparatus comprising a quartz plasma generating chamber 126, a pair of coils 134, 136 (first and second magnetic coils 134, 136) disposed externally to the plasma generating chamber, and a plasma gas introducing port 128 (e.g. Fig. 1 and col. 3, line 20 to col. 5, line 68).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a quartz plasma generation chamber with plasma gas introduction port as taught by Ahn et al in the apparatus of Gruen et al in view of Matsuoka et al as known parts required to generate plasma in plasma deposition apparatus.

Gruen et al in view of Matsuoka et al and Ahn et al do not teach a four phase helical antenna wound around a gap between the coils.

Nakanishi et al teach an ECR plasma apparatus comprising four phase antenna coils 14a-14d wound around a plasma generation chamber that enable the magnetic fields induced by the four phases to rotate and the intensity of such magnetic field can be controlled by changing the magnitude of currents flowing through the four coils of the antenna (e.g. Figs. 4, 7 and col. 3, line 65 to col. 5, line 25).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a four phase antenna as taught by Nakanishi et al in the apparatus of Gruen et al in view of Matsuoka et al and Ahn et al to enable control the radius of the rotating magnetic field for the ECR plasma generation.

Further, claim limitation “manufacturing a fullerene derivative, introducing fullerene into plasma, where a fullerene derivative produced as a result of reaction between the fullerene ion and  $M^+$ , to generate a positive monovalent ion  $M^+$  from a gas containing an atom  $M$  acting as a moiety” are intended use limitation and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations.

In this connection the courts have ruled:

A claim containing a “recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus” if the prior art apparatus teaches all the structural limitations of the claim. *Ex parte Masham*, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Regarding Claim 14: Matsuoka et al teach a pair of coils 26A, 26B for generating a mirror magnetic field (Fig. 5).

Further, claim limitation “which prohibits the dispersion of positive ions produced” is an intended use limitations, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations (relevant case law already cited above under claim 12).

Regarding Claim 18: Gruen et al in view of Matsuoka et al, Ahn et al and Nakanishi et al teach all limitations of the claim (as already explained above under claims 12, 14, 16) including plasma gas introducing means 128 (Ahn et al), a microwave generator 23 (Gruen et al), coil pairs 26A, 26B as a magnetic mirror (Matsuka et al – Fig. 5) and a four phased helical antenna 14a-14d (Nakanaishi et al – Fig. 4).

Further, claim limitations “which prohibits the dispersion of positive ions produced” is an intended use limitations, and since the structure of prior art meets the structural limitations of the

claim, the same is considered capable of meeting these limitations (relevant case law already cited above under claim 12) (relevant case law already cited above under claim 12).

**Claims 13, 15, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruen et al (US 5,772,760) in view of Matsuoka et al (US 5,022,977, Ahn et al (US 6,454,912) and Nakanishi et al (US 4,894,510) and Dearnaley (US 5,393,572).**

Regarding Claims 13, 17: Gruen et al in view of Matsuoka et al, Ahn et al and Nakanishi et al teach all limitations of the claim (as already explained above under claim 12) including plasma generating means, fullerene introducing means, and a substrate 21 (Matsuoka et al – Fig. 5) where a film is deposited, but do not explicitly teach the fullerene ejected by the fullerene introducing means is allowed to impinge onto the deposition substrate so that  $M^+$  and fullerene react with each other to produce a fullerene deposit on the deposition substrate.

Dearnaley teach a deposition apparatus where a fullerene stream 25 is directed towards a substrate 22 so that the same reacts with an ion beam to produce a DLC coating on the substrate (e.g. Fig. 1 and col. 3, lines 40-55).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the gas introducing means that directs the gas towards a substrate as taught by Dearnaley in the apparatus of Gruen et al in view of Matsuoka et al, Ahn et al and Nakanishi et al to enable control the deposited film properties.

Further, claim limitation “manufacturing a fullerene derivative, introducing fullerene into plasma, where a fullerene derivative produced as a result of reaction between the fullerene ion and  $M^+$ , to generate a positive monovalent ion  $M^+$  from a gas containing an atom M acting as a



moiety” are intended use limitation and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations (relevant case law already cited above under claim 12 above).

Regarding Claim 15: Matsuoka et al teach a pair of coils 26A, 26B for generating a mirror magnetic field (Fig. 5).

Further, claim limitation “which prohibits the dispersion of positive ions produced” is an intended use limitations, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations (relevant case law already cited above under claim 12).

Regarding Claim 19: Gruen et al in view of Matsuoka et al, Ahn et al, Nakanishi et al and Dearnaley teach all limitations of the claim (as already explained above under claims 12, 14, 16) including plasma gas introducing means 128 (Ahn et al), a microwave generator 23 (Gruen et al), coil pairs 134, 136 (Ahn et al) and a four phased helical antenna 118 (Hama et al).

Further, claim limitation “which prohibits dispersion of the positive ions produced” is an intended use/functional limitations, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations (relevant case law already cited above under claim 12).

**Claims 20, 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over  
Claims 13, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gruen et al (US 5,772,760) in view of Matsuoka et al (US 5,022,977, Ahn et al (US 6,454,912) and**

**Nakanishi et al (US 4,894,510) and Dearnaley (US 5,393,572) as applied to claim 12, 14, 16, 18, 22 and further in view of Sano et al (US 6,372,304)**

Regarding Claims 20, 21: Gruen et al in view of Matsuoka et al, Ahn et al and Nakanishi et al teach all limitations of the claim including a pair of coils and grid electrodes 118, 120, but do not explicitly teach electron energy control means for controlling the energy of electrons in a plasma to be in the range of 1 to 10 eV, the electron energy control means being located downstream of the high electron temperature plasma generating means in terms of the flow of plasma.

Further, applicant has invoked 35 USC 112, 6<sup>th</sup> Paragraph in respect of following claim limitations:

“electron energy control means”, for which the disclosed structure is – a control electrode 18 which is applied a variable potential” {Figs. 1, 2 and Para. 0025};

Sano et al teach a deposition apparatus comprising a plasma generation chamber 1, magnetic coils 2 placed externally around the chamber 1, a processing chamber 4 and a control electrode 14 (electron energy control means) located downstream of the plasma generating chamber, which is connected to a variable DC power supply (-50V to + 50 V) that enables to control the energy of electrons reaching the plasma processing chamber 4 (e.g. Fig. 1 and col. 4, line 37 to col. 5, line 23).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide electron energy controlling means down stream of the plasma generating means as taught by Sano et al in the apparatus of Gruen et al in view of Matsuoka et al, Ahn et al and Nakanishi et al to enable control electron energy reaching the plasma processing chamber.

Further, claim limitation regarding electron energy to be in the range of 1 to 10eV is a functional limitation, and since the structure of prior art meets the structural limitations of the claim, the same is considered capable of meeting these limitations (relevant case law already cited above under claim 12).

### ***Double Patenting***

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

Claims 12, 18, 20, 21 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-5, 10 of copending Application No. 11/659,201 (US 2009/0022648) in view of Ahn et al (US 6,454,912) and Nakanishi et al (US 4,894,510).

Claims 1-5, 10 of the copending application teach all limitations of claims 12, 18, 20, 21 of the instant application including plasma generating chamber, fullerene introducing means, magnetic field generating pair of coils, but do not teach the plasma generating chamber made from quartz, and a four phased helical antenna located between the pair of magnetic field generating coils.

Ahn et al teach a plasma deposition apparatus comprising a quartz plasma generating chamber 126, a pair of coils 134, 136 (first and second magnetic coils 134, 136) disposed externally to the plasma generating chamber, and a plasma gas introducing port 128 (e.g. Fig. 1 and col. 3, line 20 to col. 5, line 68).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a quartz plasma generation chamber with plasma gas introduction port as taught by Ahn et al in the apparatus of claims 1-5, 10 of the copending application as known parts required in plasma generating chamber of plasma deposition apparatus.

Claims 1-5, 10 of the copending application in view of Ahn et al do not teach a four phase helical antenna wound around a gap between the coils.

Nakanishi et al teach an ECR plasma apparatus comprising four phase antenna coils 14a-14d wound around a plasma generation chamber that enable the magnetic fields induced by the four phases to rotate and the intensity of such magnetic field can be controlled by changing the magnitude of currents flowing through the four coils of the antenna (e.g. Figs. 4, 7 and col. 3, line 65 to col. 5, line 25).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a four phase antenna as taught by Nakanishi et al in the apparatus of Claims

1-5, 10 of the copending application in view of Ahn et al to enable control the radius of the rotating magnetic field for the ECR plasma generation.

This is a provisional obviousness-type double patenting rejection.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 - 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on 571-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/R. D./  
Examiner, Art Unit 1792

/Karla Moore/  
Primary Examiner, Art Unit 1792